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Bietz J A & Wall J S. Wheat gluten subunits: molecular weights determined by sodium dodecyl sulfate-polyacrylamide gel electrophoresis.
Cereal Chem. 49:416-30, 1972.
[Northern Regional Research Laboratory, USDA-ARS, Peoria, IL]

Sodium dodecyl sulfate-polyacrylamide gel electrophoresis accurately revealed, for the first time, sizes and relationships of wheat endosperm proteins. Gliadins are monomers, while glutenin contains more than 15 disulfide-linked subunit types. Variation in large glutenin subunits permitted varietal identification and prediction of wheat breadmaking quality. [The *SCI*® indicates that this paper has been cited in over 120 publications since 1972.]

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The unique functionality of bread dough resides in gluten, a cohesive-elastic water-insoluble protein complex. Gluten contains both alcohol-soluble, low-molecular-weight proteins (gliadin) and alkali- or acid-soluble high-molecular-weight components (glutenin), each having unique rheological properties.[1] In the early 1970s, pioneering studies at our center based on starch gel electrophoresis and reduction demonstrated gliadin heterogeneity and gliadin-like disulfide-bonded subunits in glutenin,[2] but knowledge of structures and properties of gluten components was still limited, and their relationship to dough functionality unknown. Many fractionation techniques were useless because of gluten's high-molecular-weight constituents, associative tendencies, unusual amino acid composition, and insolubility. Gliadin was poorly characterized, and glutenin was often considered a polymer of gliadin. Thus, we regarded sodium dodecyl sulfate-polyacrylamide gel electrophoresis (SDS-PAGE) as having significant potential, since SDS has excellent solubilizing properties and SDS-PAGE separates proteins mainly by size rather than charge.[3]

Initial SDS-PAGE studies of gluten components were highly successful, revealing for the first time important differences between gliadin and glutenin subunits. Most gliadins had apparent molecular weights (M_r) near 36,500; glutenin contained subunits of at least 15 sizes, including some of unusually high M_r (133,000). Some glutenin subunits were similar in M_r to gliadins, but our later studies showed unique differences.[4] Thus, SDS-PAGE was able to relate chemical and physical differences among native proteins to their constituent polypeptides. Since glutenin's unique high M_r subunits varied among wheats, we suggested that they may influence breadmaking quality and that SDS-PAGE should facilitate wheat breeding, varietal identification, and genetic studies.

SDS-PAGE is now used extensively in every cereal protein research laboratory in the world. It is especially useful in wheat breeding, where "fingerprints" of high M_r glutenin subunits predict breadmaking quality.[5] Through its use, we now have useful models of gluten structure and hypotheses explaining wheat quality and how it varies.[6] This paper also led to studies of the storage proteins of other cereal grains and to a better understanding of their nutritional and functional differences.

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3. **Shapiro A L.** Molecular weight estimation of polypeptide chains by electrophoresis in SDS-polyacrylamide gels. *Biochem. Biophys. Res. Commun.* 28:815-20, 1967. (Cited 3,260 times.)
4. **Bietz J A & Wall J S.** Isolation and characterization of gliadin-like subunits from glutenin. *Cereal Chem.* 50:537-47, 1973.
5. **Payne P I, Corfield K G & Blackman J A.** Identification of a high-molecular-weight subunit of glutenin whose presence correlates with bread-making quality in wheats of related pedigree. *Theor. Appl. Genet.* 55:153-9, 1979.
6. **Bietz J A & Wall J S.** Identity of high molecular weight gliadin and ethanol-soluble glutenin subunits of wheat: relation to gluten structure. *Cereal Chem.* 57:415-21, 1980.

